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has been shut off, largely interbreeding; these are Louisiana, Mississippi, South Carolina, North Carolina, Virginia, Vermont, Maine.

The analysis of the experience in New York state by sections shows:

With regard to tuberculosis, the highest is in the Adirondack region, a resort for consumptives; the lowest is in the suburbs of New York City.

With regard to venereal diseases, the highest is in the "western manufacturing section," including Buffalo; the lowest is again in the suburbs of New York City, with the city itself a close second.

With regard to mental defects, the highest is in the Catskill section, with its old, long-settled, intermarrying regions, while the very lowest is in New York City. The Catskill section has also the highest percentage of epilepsy.

MILES M. DAWSON

The Problem of Estimation. By Correa Moylan Walsh. London: P. S. King & Son. 144 pp.

This little monograph, by the author of *The Measurement of General Exchange Value*, will be welcomed by all students of index numbers. It will doubtless be read by many such who have not been willing to devote the greater time required for reading the author's earlier and larger book. The present volume does in fact include the gist of the larger work besides adding the author's later and maturer conclusions. The earlier book, *The Measurement of General Exchange Value*, is the most elaborate and scholarly book on index numbers that has yet appeared and it has therefore become a classic in the literature of that subject; although, because of its minute and technical character, it has inevitably had very few readers.

Having read and reread both books I am filled with admiration for the author's keenness and for his painstaking industry. He has covered very thoroughly the antecedent literature and has worked out the details and the peculiarities of many formulae and methods. Inasmuch as the author does not consider himself a mathematician, his thoroughness and penetration in what is, after all, a mathematical field, seem remarkable.

If I were to offer any adverse criticism it would be chiefly that the method of the writer seeks too much to lead the reader from the consideration of special cases up to general cases, instead of the reverse. In some instances, at least, he could have made it easier for the reader, if not for himself, had he proceeded in the opposite direction. As J. Willard Gibbs, the mathematical physicist used to say, "the whole is simpler than its parts."

It should be stated that *The Problem of Estimation* is more than a treatise on index numbers. The subject of index numbers proper occupies only the last fifty pages. The other ninety pages will be of less interest to the economist, although they help materially to introduce the author's presentation of the theme of index numbers.

The book consists of an Introduction in which "the controversy" is formulated, a second part on "Averages and Errors," and a third part on "Deviations and Variations."

The "controversy" is presented rather entertainingly by propounding an old problem treated by Galileo and others of his time: "If a horse worth one hundred crowns is estimated by one person at one thousand and by another at ten, which of these two estimates is the less erroneous, or are they equally erroneous?" Galileo maintains that the two guesses are equally erroneous, while a certain Nozzolini stoutly argues that 10 is nearer the mark (100) than is 1,000. This leads naturally to a discussion of the arithmetic and geometric means. Geometrically, ten and one thousand are equally distant from one hundred, one being ten times as much and the other ten times as little, whereas, arithmetically, ten is nearer one hundred than one thousand, being only distant by a difference of ninety as compared with the other difference of nine hundred.

As in his former work, the author devotes most of his effort to contrasting the advantages and disadvantages, for various purposes, of the geometric, arithmetic, and harmonic means. He offers various criticisms—not always very important—of other writers on index numbers, including Edgeworth, Bowley, and myself.

One of the parts of the book which most interested me, personally, is that concerning the formula on page 102. This is the formula which I have offered in the March number of the QUARTERLY PUBLICATIONS as the best formula for an index number. Walsh, from an entirely different approach, has reached the same conclusion. The particular merit of this formula, which he seems to regard as the most important, is quite apart from the merits which I have brought forward. It is that this formula comes nearest to fulfilling "Westergaard's test." No formula has been found which completely satisfied Westergaard's test (except formulae with obviously improper weighting). This so-called test of a good index number is that, by its use, a comparison between two years *directly*, such as 1913 and 1921, ought to correspond to the result obtained *indirectly*, by putting together a chain of index numbers for intervening years. Although the formula which he and I agree is the best does not perfectly fulfil Westergaard's test, he thinks it comes nearer to it than any rival formula.

It was evidently the hope of finding the formula that would fulfil Westergaard's test which has twice called Walsh into this field of research. He is disappointed not to have found the object of his search, and expresses a suspicion that perhaps the problem, like squaring the circle, is after all insoluble.

As I stated in my March paper, I hope to show later that this suspicion is well grounded and, furthermore, that Westergaard's test is not a true test at all, but presents an ideal which is not only unattainable but false.

But just as the search for a method of squaring the circle or discovering "the north-west passage" were by no means fruitless, so Walsh's research has reached many results of value to science, especially to the science of Index Numbers.

IRVING FISHER

Rules for Reporting Information on Railroad Employees, together with a Classification and Index of Steam Railroad Occupations. Reporting forms and classification plan, prepared by the United States Railroad Labor Board, and approved by the Interstate Commerce Commission, to be used by carriers